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UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

INFORMATION CIRCULAR

MARKETING FELDSPAR

BY

ROBERT W. METCALF

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I.C. 7184,
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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

MARKETING FELDSPAR[1]

By Robert W. Metcalf[2]

CONTENTS

	Page
Properties	1
Occurrence	2
Market grades	2
Crude spar	2
Ground spar	3
Glass spar	3
Pottery spar	3
Glaze spar	3
Domestic production and consumption	4
Localities of production	5
Milling centers	5
Mining	5
Some producers of crude feldspar	7
Merchant grinders of feldspar	9
Buyers of feldspar	11

PROPERTIES

The feldspars are a series of related aluminum silicates containing varying proportions of potash, soda, and lime; smaller amounts of other minerals are likely to be present as impurities. They comprise three principal types: Potash spars, microline and orthoclase ($KAl_2Si_2O_8$); soda feldspar or albite ($NaAlSi_3O_8$); and soda-lime (plagioclase) feldspars. The last-named is an intermediate group ranging from albite through oligoclase, andesine, labradorite, and bytownite to anorthite or lime feldspar ($CaAl_2Si_2O_8$). Minor varieties are barium feldspar or celsian and a potash-barium feldspar. Perthite is a mixture of orthoclase and albite in alternate layers. Graphic granite or "corduroy spar" is an intergrowth of feldspar and quartz characteristically in the ratio of 3:1. Cornwall stone is a natural mixture of feldspar, quartz, and kaolinite imported in former years in sizable quantity from Cornwall, England. (A similar synthetic mixture, including some fluorspar, has been blended and marketed in the United States as "Carolina stone".)

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[1] The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7184."

[2] Nonmetal Economics Division, Bureau of Mines.

Properties of the feldspars are similar. The whole group has about the same hardness (6 to 6.5), with good cleavage in two directions at or about 90°. Uneven fracture, pearly to vitreous luster, and white streak are characteristic. Colors range from white, cream, or pink to milky, red, brown, gray, and green. Most of them are triclinic in crystallization, except for orthoclase, which is monoclinic. The specific gravity for potash spars is 2.56, for albite 2.60, and for anorthite 2.76. Melting points are as follows: Potash spar, 1,200°C.; albite, 1,110°C.; and anorthite, 1,532°C.

OCCURRENCE

Although the feldspars comprise about 60 percent of all igneous rocks, the only deposits considered workable have been the granitic pegmatites, coarsely crystalline dikes, or lenses in which at least partial segregation of the minerals already has been affected through natural means and from which relatively large pieces of spar can be obtained by hand-sorting the coarsely broken rock. The rarer soda pegmatites are utilized less frequently.

Commercial feldspars are intergrowths of at least two species, chiefly the potash and soda types; the pure minerals almost never occur in nature. Accessory minerals present include quartz, muscovite (white mica), biotite (black mica), garnet, beryl, and tourmaline, which are considered to be impurities and consequently should be removed as much as possible before sale; the iron-bearing biotite, garnet, and tourmaline are especially deleterious.

MARKET GRADES

Crude Spar

Since feldspar varies considerably in composition from mine to mine and even changes appreciably within the same deposit, it is exceedingly difficult to make any scientific classification of the raw, unground product. Most of the feldspar produced in this country is marketed in the ground state For crude spar there is only a rather elastic commercial distinction between No. 1 and No. 2 spar. No. 1 spar is the selected grade of crude mined in any particular district, and No. 2 is a less pure product from that district with higher quartz and muscovite content. However, in some districts No. 1 spar carries no free quartz and in others it may contain as much as 10 or 15 percent. No. 2 spar should not contain over 25 percent free silica and No. 3, which is specified in only a few districts, not over 30 percent free silica or quartz. Both No. 1 and No. 2 spar should be sufficiently free from iron-bearing substances to burn to a clear, white color free from speck

Dental feldspar is a carefully selected, hand-sorted, crude potash spar comprising only perfectly clear crystals free from all impurities. It commands a high premium over first-grade commercial spar but is marketed in comparatively small quantities. Considerable tonnages of crude feldspar are sold for use in various soaps or cleansers. This material should be entirel free from quartz (grit) but may contain more mica than can be tolerated in ceramic spar. Some crude spar also is shipped or sold to certain manufactur of sanitary and enamel ware and pottery, who grind it as needed for their own use. Coarsely crushed feldspar, supplied in large part by firms not connected with the ceramic trades, is marketed for use as roofing granules, concrete aggregate, stucco, and poultry grit. Manufacturers of fillers and of miscellaneous abrasives also utilize feldspar.

Ground Spar

Actuated in the late 1920's by increased consumer insistence on more reliable raw-material performance and improved grinding equipment, the feldspar industry accepted a commercial standard (CS 23-30), published by the National Bureau of Standards, effective September 1, 1930. The classifications of ground spar therein set forth were based both upon chemical composition and fineness of grinding. The agreement also specified standard methods for making screen tests and complete chemical analyses. Another set of standards was prepared without reference to CS-23-30 and promulgated under the feldspar code of the N.R.A., but miners and small grinders claimed that this was too complicated. Revised standards were under consideration when the N.R.A. went out of existence. In December 1935 the National Feldspar Association published a modified, less-involved classification based upon use rather than analysis, eliminating the alkali ratio and raising the silica tolerance to 3 percent.

Since commercial feldspars contain at least two types of feldspar and a number of accessory minerals, an infinite variety of combinations is possible and any rigid set of specifications tends to be complicated. Avoiding technicalities, however, it is possible to distinguish only three or four important grades. Roughly, in the order of quantities used, these are glass spar, pottery spar, and glaze spar.

Glass spar. - Spar is used in glassmaking, primarily as a source of alumina, and either soda or potash spar is acceptable; some glassmakers prefer soda to potash. No. 2 glass spar must contain at least 17 percent Al_2O_3 and a maximum of 0.1 percent Fe_2O_3. The minimum for total alkalies (Na_2O plus K_2O) is 11.5 percent. For No. 1 glass spar the free-quartz content is limited to a maximum of 6 percent. Lime is usually quite low - 2 percent or less CaO.

Pottery spar. - Analyses of pottery spars range from 73 to 65 percent SiO_2, 12.5 to 3.5 percent K_2O; 1.5 to 6.5 percent Na_2O, and 0.10 to 0.05 Fe_2O_3. However, high-potash spar is usually preferred.

Glaze spar, on the other hand, is typically high-soda and contains 4 percent or more Na_2O.

Grinding is different for different uses. For both pottery and glaze uses the material is ground quite fine - 99 percent through 200-mesh, with 40 percent minus 20 microns. Owing to the preference for small sizes, air-swept mills are not favored, and there are still potters who insist on batch-ground spar. Conversely, for glassmaking fines are not desired, so material

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for this use is put through only 20-mesh, and occasionally a limit is placed upon the allowable percentage of minus-200-mesh. One company makes three grades of glass spar - regular (42 to 65 percent on 200 mesh), semigranular (65 to 85 percent on 200-mesh), and granular (85 percent or more on 200-mesh).

By far the most serious barrier to marketing some feldspar mixtures is their iron content. Although magnetic treatment has become almost universal, certain mixtures cannot be separated mechanically because the iron minerals are mixed too intimately with the spar to be released in coarse grinding. Iron in the form of a stain is less objectionable than garnet and biotite, which tend to produce specks in fired or fused products.

Quartz formerly was considered a universally objectionable impurity, but many consumers now consider it merely as a diluent, and much feldspar is sold today that would have been quite unmarketable a quarter century ago.

Ground feldspar sold by merchant mills in the United States, 1938-40, by uses in short tons

	1938		1939		1940	
	Short tons	Percentage of total	Short tons	Percentage of total	Short tons	Percentage of total
Ceramic:						
Glass.............	117,800	54.9	138,336	53.4	149,623	52.4
Pottery...........	74,035	34.5	87,209	33.7	104,586	36.6
Enamel............	19,395	9.0	28,356	10.9	26,420	9.3
Other ceramic uses	2,077	1.0	2,132	.8	649	.2
Soaps and abrasives.	1,021	.5	770	.3	2,682	.9
Other uses..........	186	.1	2,391	.9	1,753	.6
	214,514	100.0	259,194	100.0	285,713	100.0

DOMESTIC PRODUCTION AND CONSUMPTION

Production. - The United States is by far the largest producer of feldspa Domestic production of crude feldspar which was only 26,462 long tons in 1912, rose to 236,108 tons in 1928 and after dropping to 117,281 tons in 1932 advanc to 268,532 tons in 1937 and 290,763 tons in 1940. North Carolina in 1940 furnished 27 percent of the national total; South Dakota, 19 percent; New Hampshire, 13 percent; Colorado, 12 percent; and Connecticut, 8 percent. A considerable part of the output of Canadian crude feldspar is shipped into the United States for processing. European needs normally are supplied principall by Sweden and Norway.

Consumption. - The chief consumers of feldspar are the glass, pottery, and enamel industries, which together take over 95 percent of the feldspar ground in the United States. In 1940, 52 percent of the total feldspar ground was used in the manufacture of glass, 37 percent by potteries, and 9 percent by enamel plants. About 83 percent of the quantity ground in that year was shipped into seven States - Ohio, Pennsylvania, New Jersey, Illinois, Indiana, West Virginia, and New York, in order of size of shipments.

Localities of Production

North Carolina, Virginia, Maine, New Hampshire, New York, and Connecticut are the principal producing States in the East. North Carolina produces a wide variety of spars, with both potash and soda spars plentiful, while Virginia feldspar is mainly of the potash type, although some soda spar is mined. The Connecticut and New Hampshire output is largely potash feldspar, although New Hampshire also has higher-grade soda spars. Maine has varied types, with potash spars and graphic granite predominating. New York at present produces mostly a soda spar for glaze purposes. Small quantities (chiefly glaze spar) annually are mined in Pennsylvania and Maryland; both States were formerly important feldspar-producing areas.

High-grade potash feldspar is mined in Colorado. South Dakota's output consists largely of high-quality potash spar; some soda spar is also mined. Arizona and California produce chiefly potash spar. Output in Wyoming thus far is potash feldspar.

Milling centers

Practically all the feldspar mined in North Carolina and Virginia, except that sold to soap manufacturers and to certain large enameling plants, is ground in the Spruce Pine (N. C.) district; at Erwin, Tenn.; and at Brookneal and Bedford, Va.

Mills in Maine and New Hampshire process local feldspars, although large quantities of Maine and Connecticut spars are ground in Trenton, N. J. The plant at East Liverpool, Ohio (now discontinued), handled feldspars from several producing States, including North Carolina, Maine, and Maryland. A mill near New York City grinds the local Bedford spar. At Rochester, N. Y., there is a plant that processes Canadian feldspar. Grinding establishments in California, Arizona, Colorado, and South Dakota are supplied by nearby mines, although Colorado mills supplement local supplies by grinding Wyoming feldspar and purchasing small quantities of South Dakota spar. South Dakota operators have reported small purchases from Wyoming, and South Dakota crude spar is ground in Illinois by a sanitary-ware manufacturer.

MINING

A considerable portion of the feldspar mined in the United States is produced by small individual operators, often farmers or others working in their spare time. Hand methods have resulted in highly selective mining, the working of the most productive sections of the pegmatite deposits, and much waste of good recoverable spar. Even with such crude mining (except perhaps in South Dakota and Colorado) it apparently has been difficult to produce good, clean spar for less than $5.00 or even $6.00 a ton. These higher costs reflect the increasing scarcity and gradual exhaustion of the higher-grade deposits workable by present wasteful methods.

A high proportion of the feldspar mined has been rejected either at the mine or grinding mill. Most of the fines are lost, as tined forks often are

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used to recover material from mine stocks or from bins at the mill, and the fine material is said to contain higher percentages of impurities. The majority of users still prefer to purchase their feldspar and quartz separately and to blend their batches from relatively pure mixtures. In one or two recent instances, however, a quartz-feldspar mixture has been used as mined with seemingly satisfactory results. Artificial mixtures corresponding roughly to the composition of Cornwall stone also have been marketed, and nepheline syenite is sometimes mixed with low-grade feldspars to obtain a product of higher grade. In future, a large proportion of the feldspar requirements of the United States may be obtained by milling coarse-grained granites or other massive-type rocks rather than from the currently utilized pegmatite dykes.

The following tables show recent trends in production (sales) of crude and ground feldspar in the United States.

Crude feldspar sold or used by producers
in the United States, 1929-40
(Value at mine or nearest shipping point)

Year	Long tons	Value	Year	Long tons	Value
1929	197,699	$1,418,975	1935	189,550	$1,005,021
1930	171,788	1,066,636	1936	244,726	1,303,090
1931	147,119	861,059	1937	268,532	1,383,249
1932	104,715	539,641	1938	196,119	895,081
1933	150,633	778,826	1939	253,466	1,112,857
1934	154,188	853,136	1940	290,763	1,271,995

Ground feldspar sold by merchant mills
in the United States, 1929-40

Year	Short tons	Value	Year	Short tons	Value
1929	230,582	$3,296,252	1935	200,095	$2,659,140
1930	181,541	2,450,915	1936	236,890	3,154,853
1931	143,924	1,853,393	1937	279,272	3,486,741
1932	107,749	1,240,492	1938	214,514	2,466,252
1933	133,008	1,617,552	1939	259,194	2,862,278
1934	144,178	1,868,500	1940	285,713	3,065,482

SOME PRODUCERS OF CRUDE FELDSPAR

ARIZONA

Kingman Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.

CALIFORNIA

American Radiator & Standard Sanitary Corporation, Pacific Mines, Campo, Calif.
Gladding, McBean & Co., 2901 Los Feliz Blvd., Los Angeles, Calif.

COLORADO

The M. & S. Inc., 1333 West Maple Ave., Denver, Colo.
Robert A. Shipley, 922 Main St., Canon City, Colo.
E. E. Zingheim, Route 1, Box 558, Canon City, Colo.
Colorado Feldspar Co., Trenton Trust Bldg., Trenton, N. J.
H. J. Jewett, Canon City, Colo.
Donald E. Clements, South Platte, Colo.

CONNECTICUT

The Worth-Spar Co., Middletown, Conn.
Eureka Flint & Spar Co., New York Ave., Trenton, N. J.
James Quaglioroli, South Glastonbury, Conn.

MAINE

Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.
James Russo, Brunswick, Maine.
Harry E. Bumpus, 15 Vining St., Auburn, Maine.
Howard M. Irish, Buckfield, Maine.
United Feldspar & Minerals Corporation, Oxford Division, West Paris, Maine.
Cesare Trusiani, Brunswick, Maine.
Topsham Feldspar Co., Topsham, Maine.
Howard Baker, 304 Spring St., Portland, Maine.

NEW HAMPSHIRE

Golding-Keene Co., Box 224, Trenton, N. J.
Julian Wetherbee, 22 Wheelock St., Keene, N. H.
Seaboard Minerals Corporation, 52 William St., New York, N. Y.
The Whitehall Co., Inc., 17 Battery Place, New York, N. Y.
John F. Balla, South Acworth, N. H.

NEW YORK

White Hill Mineral Co., Inc., 12 Park St., Gouverneur, N. Y.
Atlas Feldspar Corporation, Broadalbin, N. Y.
Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.

NORTH CAROLINA

The Whitehall Co., Inc., 17 Battery Pl., New York.
Waites Pitman, Penland, N. C.
Carolina Mineral Co., Erwin, Tenn.
Penland Feldspar & Kaolin Co., Penland, N. C.

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NORTH CAROLINA (continued)

Carolina China Clay Co., Penland, N. C.
United Feldspar & Minerals Corporation, Minpro Division, Spruce Pine, N. C.
Blue Ridge Mining Co., Burnsville, N. C.
Young & Thomas, Geo. Young, Mgr., Boonford, N. C.
Backus Mining Co., Micaville, N. C.
Hubert O. DeBeck, Burnsville, N. C.
Feldspar Producing Co., Erwin, Tenn.

PENNSYLVANIA

Domenico Ciaffoni, R. F. D. 6, West Chester, Pa.

SOUTH DAKOTA

F. E. Schundler Feldspar Co., Custer, S. Dak.
Abingdon Sanitary Mfg. Co., Abingdon, Ill.
Harry A. Linde, Keystone, S. Dak.
Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.
Lawrence Judson, Keystone, S. Dak.
Keystone Feldspar & Chemical Co., 141 West Jackson Blvd., Chicago, Ill.
Clark Butts, Keystone, S. Dak.
Magnuson & Tinsley, Custer, S. Dak.
John Ross, Custer, S. Dak.
Fred Roufs, Custer, S. Dak.
A. E. Lyndoe, Keystone, S. Dak.

VIRGINIA

Virginia Feldspar Co., Bedford, Va.
Seaboard Feldspar Co., 430 Hearst Tower Bldg., Baltimore, Md.
Dominion Minerals, Inc. (V. V. Kelsey, Pres.), 719 15th St., N. W., Washington, D. C. (aplite).

WYOMING

The M. & S. Inc., 1333 W. Maple Ave., Denver, Colo.
John L. Funk, Laramie, Wyo.
Fred & Chas. Abernathy, P. O. Box 88, Lander, Wyo.
A. H. Maxwell, Lander, Wyo.

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MERCHANT GRINDERS OF FELDSPAR

	Location of mill
ARIZONA	
Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.	Kingman
CALIFORNIA	
American Radiator & Standard Sanitary Corporation, Pacific Mines, Campo, Calif.	Campo
Gladding, McBean & Co., 1919 East 52d St., Los Angeles, Calif.	Los Angeles
Industrial Minerals & Chemical Co., 6th and Gilman Sts., Berkeley, Calif.	Berkeley
COLORADO	
Colorado Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.	Canon City
Coors Porcelain Co., Golden, Colo.	Golden
Western Feldspar Milling Co., 1333 W. Maple Ave., Denver, Colo.	Denver
ILLINOIS	
Abingdon Sanitary Mfg. Co., Abingdon, Ill.	Abingdon
MAINE	
Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.	Topsham
United Feldspar & Minerals Corporation, Oxford Division, West Paris, Maine.	West Paris
Topsham Feldspar Co., Brunswick, Maine.	Cathance
NEW HAMPSHIRE	
Golding-Keene Co., Box 224, Trenton, N. J.	Keene
Seaboard Minerals Corporation, 52 William St., New York, N. Y.	Cold River
NEW JERSEY	
Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.	Trenton
Eureka Flint & Spar Co., Inc., New York Ave., Trenton, N. J.	do.
Standard Flint & Spar Corporation, 1401 New York Ave., Trenton, N. J.	do.
NEW YORK	
Atlas Feldspar Co., Broadalbin, N. Y.	Broadalbin
Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.	Bedford & Rochester
Genesee Feldspar Co., Inc., 360 Boxart St., Rochester, N. Y.	Rochester
White Hill Mineral Co., Inc., Gouverneur, N. Y.	DeKalb

	Location of mill
NORTH CAROLINA	
Feldspar Milling Co., Inc., Burnsville, N. C.	Bowditch
Southern Feldspar, Inc., Toecane, N. C.	Toecane
United Feldspar & Minerals Corporation, Minpro Division, Spruce Pine, N. C.	Spruce Pine
SOUTH DAKOTA	
Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.	Keystone
F. E. Schundler Feldspar Co., Custer, S. Dak.	Custer
TENNESSEE	
Consolidated Feldspar Corporation, Trenton Trust Bldg., Trenton, N. J.	Erwin
North Carolina Feldspar Corporation, Erwin, Tenn.	do.
VIRGINIA	
Seaboard Feldspar Co., Hearst Tower Bldg., Baltimore, Md.	Brookneal
Virginia Feldspar Co., Bedford, Va.	Bedford
Dominion Minerals, Inc., 719 15th St., N. W., Washington, D. C. (aplite)	Piney River

BUYERS OF FELDSPAR

CALIFORNIA

Industrial Minerals & Chemical Co., 6th and Gilman Sts., Berkeley.
Chamberlain Co., 2550 East Olympic Blvd., Los Angeles.
Pomona Tile Mfg. Co., 629 N. La Brea Ave., Los Angeles.
Gladding, McBean & Co., 9th and Harrison Sts., San Francisco.

DELAWARE

E. I. du Pont de Nemours and Co., Inc., R. & H. Chemicals Dept., Dupont Bldg., Wilmington.

ILLINOIS

F. E. Schundler & Co., 606 Railroad St., Joilet.
Tamms Silica Co., 228 No. LaSalle St., Chicago.

INDIANA

Architectural Tiling Co., Inc., Anderson.
National Tile Co., Inc., Anderson.

MARYLAND (BALTIMORE)

Locke Insulator Corporation, Lynn and Nairn Sts.
Seaboard Feldspar Co., Hearst Tower Bldg.

MASSACHUSETTS

Norton Co., 50 New Bond St., Worcester.

MICHIGAN (DETROIT)

Champion Spark Plug Co., Ceramic Div., 8525 Butler Ave.
Square-D Company, Switch and Panel Div., 6060 Rivard St.

NEW HAMPSHIRE

Golding-Keene Co., Keene.

NEW JERSEY

Fords Porcelain Works, Perth Amboy.
Washington Porcelain Co., Washington.

TRENTON:

Consolidated Feldspar Corporation, Trenton Trust Bldg.
Cook Ceramic Mfg. Co., 500 Prospect St.
Eureka Flint & Spar Co., Inc.
Frenchtown Porcelain Co., Muirhead and Dewey Aves.
Imperial Porcelain Works, New York Ave. and Mulberry St.
Lenox, Incorporated.
New Jersey Porcelain Co., Inc., Carson and Plum Sts.
Scammel China Co.
Standard Flint & Spar Corporation.
Star Porcelain Co., Muirhead and Dewey Aves.
Trenton Potteries Co., Inc.
Union Electrical Porcelain Works, Muirhead and Van Orden Sts.

NEW YORK

American Radiator & Standard Sanitary Corporation, 40 West 40th St., New York City.
General Ceramics Co., 30 Rockefeller Plaza, New York City.
General Electric Co., Schenectady.
Genessee Feldspar Co., Inc., 360 Boxart St., Rochester.
Lapp Insulator Co., Inc., Gilbert and Mills St., Le Roy.
Minerals & Insulation Corporation, 139 Spring St., New York City.
Onondaga Pottery Co., Syracuse.
Porcelain Metals, Inc., Borden Ave. and Dutch Kills, Long Island City.
United Feldspar & Minerals Corporation, 10 East 40th St., New York City.
Victor Insulators, Inc., Maple Ave., South, Victor.
Whitehall Co., Inc., 17 Battery Pl., New York City.
Whittaker, Clark & Daniels, Inc., 260 West Broadway, New York City.

NORTH CAROLINA

Carolina China Clay Co., Penland.
Feldspar Milling Co., Inc., Burnsville.
Penland Feldspar & Kaolin Co., Penland.
Southern Feldspar Inc., Toecane.

OHIO

Akron Porcelain Co., Kenmore Sta., Akron.
Colonial Insulator Co., Firestone Park, Akron.
Crooksville China Co., Crooksville.
Davidson Enamel Products, Inc., 800 East Kirby St., Lima.
Limoges-Sebring Associates, Sebring.
National Sales Corporation, 31-35 East 13th St., Cincinnati.
Ohio Brass Co., 100 Surrey Rd., Mansfield.
Porcelain Products, Inc., 1941 Carey St., Findlay.
Salem China Co., Salem.
R. Thomas & Sons Co., 1937 Holmes St., Lisbon.
Wellsville China Co., Wellsville.

CLEVELAND:

Ferro-Enamel Corporation, 4150 East 56th St.
Harshaw Chemical Co., 1933 East 97th St.

EAST LIVERPOOL:

Ball China Co.
Edwin M. Knowles China Co.
Specialty Porcelain Works
Taylor, Smith & Taylor Co.

PENNSYLVANIA

Ingram-Richardson Mfg. Co., 1938 McMillan St., Beaver Falls.
Pittsburgh Plate Glass Co., 1222 Grant Bldg., Pittsburgh.
H. K. Porter & Co., Inc., 48th and Harrison Sts., Pittsburgh.
Saxonburg Potteries, P. O. Box 100, Saxonburg.
Shenango Pottery Co., New Castle.
Westinghouse Electric Mfg. Co., Hill St., East Pittsburgh.

TENNESSEE
Knox Porcelain Corporation, 150 Mynders St., Knoxville.
North Carolina Feldspar Corporation, Erwin.
Carolina Mineral Co., Erwin.

WEST VIRGINIA
Bowers Pottery Co., Mannington.
Carr China Co., Grafton.
Jeffery-DeWitt Insulator Co., Kenova.
Homer-Laughlin China Co., Newell.
D. E. McNicol Pottery Co., Clarksburg.
Wheeling Tile Co., Wheeling.
PARKERSBURG:
Porcelain Products Co., Inc., 1941 Broadway.
Superior Porcelain Co.
U. S. Quarry Tile Co.

WISCONSIN
Kohler Co., Kohler.
Wisconsin Porcelain Co., Main and Lincoln Sts., Sun Prairie.

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